THE FIRST-DEGREE EQUATION TEACHING FOR STUDENTS WITH VISUAL DISABILITIES: SYSTEMATIZING SCIENTIFIC STUDIES

O ENSINO DE EQUAÇÃO DO PRIMEIRO GRAU PARA ALUNOS COM DEFICIÊNCIA VISUAL: SISTEMATIZAÇÃO DE ESTUDOS CIENTÍFICOS

LA ENSEÑANZA DE ECUACIÓN DE PRIMER GRADO PARA ESTUDIANTES CON DISCAPACIDAD VISUAL: SISTEMATIZACIÓN DE ESTUDIOS CIENTÍFICOS

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ABSTRACT: Intending to contribute to the teaching work of mathematical content, this research aimed to carry out a systematic review of research aimed at teaching first-degree equations for visually impaired students, available in the CAPES Thesis and Dissertations Catalog. As the most specific search resulted in no research found, we then searched for "visual impairment mathematics". The second search resulted in nine articles, of which six are analyzed in this research. Finally, we explain the results obtained, the scarcity of research, the importance of the teacher, the difficulties in the classroom and a proposal for future research.

KEYWORDS: Inclusive education. Mathematics teaching. First-degree equation.

RESUMO: *Visando contribuir para o trabalho docente de conteúdos matemáticos, essa pesquisa teve como objetivo realizar uma revisão sistemática de pesquisas voltadas ao ensino de equações do primeiro grau para alunos com deficiência visual, disponíveis no Catálogo de Teses e Dissertações da CAPES. Como a busca mais específica resultou em nenhuma pesquisa encontrada, buscou-se então, sobre "matemática deficiência visual". A segunda busca resultou em nove artigos, dos quais seis se encontram analisados nessa pesquisa. Por fim, explanamos os resultados obtidos, a escassez de pesquisas, a importância do professor, as dificuldades na sala de aula e uma proposta para pesquisas futuras.*

PALAVRAS-CHAVE: *Educação Inclusiva. Ensino de Matemática. Equação do Primeiro grau.*

RESUMEN: *Con el objetivo de contribuir a la labor docente de contenidos matemáticos, esta investigación tuvo como objetivo realizar una revisión sistemática de la investigación orientada a la enseñanza de ecuaciones de primer grado para estudiantes con discapacidad visual, disponible en el Catálogo de Tesis y Disertaciones de CAPES. Como la búsqueda más específica resultó en que no se encontró ninguna investigación, luego buscamos "matemáticas de discapacidad visual". La segunda búsqueda resultó en nueve artículos, de los cuales seis son analizados en esta investigación. Finalmente, explicamos los resultados obtenidos, la escasez de investigación, la importancia del docente, las dificultades en el aula y una propuesta de investigación futura.*

PALABRAS CLAVE: *Educación inclusiva. Enseñanza de las matemáticas. Ecuación de primer grado.*

Introduction

The general objective of this research was to conduct a systematic review of research on the teaching of First-Degree Equation for visually impaired students available in the CAPES Theses and Dissertations Catalogue. To this end, theoretical studies were developed in order to identify the elements that characterize and define visual impairment, to expand knowledge about the historical course of educational care aimed at students with visual impairment and to understand the process of teaching and learning mathematical contents, involving students with blindness or low vision. Based on these studies, the research focused on the identification and analysis of studies focused on the teaching of first-grade equations for visually impaired students in the Capes Theses and Dissertations Catalogue.

Thus, this article contemplates the results of the research conducted, first bringing the considerations about the historical evolution of inclusion, with emphasis on the differences between the concepts of integration, standardization and inclusion.

The following are the characteristics that define visual impairment, the distinction between visual impairment and low vision, which allows us to observe that there are classifications in relation to visual acuity that determines the degree of blindness and the possible causes that can cause this deficiency.

Considering the research development process, from the methodological point of view, the results of the research are presented, which include the discussions about visual impairment and the teaching of mathematics and the analysis of research aimed at teaching first-degree equations to students with visual impairment. This is the result of the research and systematization work, in digital databases, starting with the CAPES Theses and Dissertations Catalogue and contemplating the CAPES Journal Portal, with analyses related to localized works. Finally, the considerations of this research are presented, with the perspective of the importance of this for the area of education and the future possibilities in the scientific field.

Historical evolution of inclusion

In a global scenario, education for children and young people with sensory disabilities, which is characterized by a non-functioning of some of the senses, began in the year 1960, in some European countries, in which the student with disabilities was in the regular classroom with the other students, accompanied by a specialized teacher. This was the starting point for

other inclusion movements over the following years.

We can highlight two events of paramount importance for inclusive education, including the World Conference on Education for All, held in 1990 in Jomtien, Thailand, and the World Conference on Education, held in 1994, in Salamanca, Spain.

For contextualization purposes, Mendes (2006) brings a picture about education in poor and developing countries, evidencing that measures should be taken to improve education. According to Ormindo (2019), the main theme of the World Conference on Education for All, held in 1990, was the inability of the methods used so far to reduce the number of illiteracy and the lack of quality in the teaching offered. Brazil was present and, together with the other participating countries, reaffirmed its commitment to education for all:

> According to Zeppone's analysis (2011), at the 1990 Conference the problems to be solved were defined, lines of actions were determined to solve them and deadlines to achieve the expected goals. Although the reasons were legitimate and the intentions were good, the author states that little of what was defined came into practice by the countries, most of the definitions established did not even come to the knowledge of the schools, 21 remaining only in the possession of the rulers who defined them. When the time came to show the results, many of the solutions thought were hastily implemented, not yielding the expected benefits (ORMINDO, 2019, p. 20, our translation).

A major gain for inclusive education in the global context, coming from the Salamanca Declaration, was the social inclusion movement. In this document, society as a whole has a role to play in promoting inclusion, equating opportunities, seeking the construction of a democratic society, in which personal diversities and characteristics would be respected and accepted, as Mendes points out (2006, p. 395).

Questions begin to be asked about the ideal of inclusion, from the moment the subject becomes global. Mendes (2006) highlights several questions on the subject, with this there is reflection: is inclusion really for everyone?

In the Brazilian context, we see throughout history that people with a higher purchasing power had access to quality education, while low-income people had access to a precarious education when they had this access. People with some type of disability, when low income, were excluded, even being considered genetically inferior.

Based on the aspects pointed out by Mendes (2015), it is possible to see that teaching for people with disabilities in Brazil had its first step in 1835, with the then Deputy Cornélio Ferreira, who presented a bill for the position of literacy teacher for blind people and deaf-mute people.

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It is worth mentioning that the term deaf-mute is no longer used, because it is not all deaf that is also dumb, many have vocal cords functioning perfectly, just did not learn to speak for lack of hearing. However, they are able to learn speech through lip reading, for example. The term mentioned was used in the old days, for lack of the knowledge we have today.

In the following years, other projects and institutes were developed in Brazil, of which we can highlight the creation of the Imperial Institute of the Blind Boys, by D. Pedro II, on September 12, 1854 and later called the Benjamin Constant Institute. On September 26, 1857, also by D. Pedro II, the Imperial Institute of the Deaf-Mute was inaugurated.

Given this scenario, both globally and in Brazil, people with disabilities only began to have their rights and to be seen as citizens, active participants of society, after the Universal Declaration of Human Rights of 1948. Of this, it is notorious to highlight the 26th article that says:

> Article 26 1. Everyone has the right to education. Education should be free of charge, at least corresponding to primary elementary education. Elementary school is mandatory. Technical and vocational education should be generalized; access to higher education should be open to all on equal terms, depending on their merits. 2. Education shall aim at the full expansion of human personality and the strengthening of human rights and fundamental freedoms and shall foster understanding, tolerance and friendship between all nations and all racial or religious groups, as well as the development of UN peacekeeping activities (ONU, 1948, our translation).

At the end of the 1940s and in the early 1950s, approximately, there were in Brazil certain of 40 institutions for the teaching of people with mental disabilities, with most belonging to the public sector. An important point, in 1954, occurred the creation of the first special private philanthropic school, the Association of Parents and Friends of The Exceptional (APAE).

The term education for the exceptional is explained in Article 88 of the Law of Guidelines and Bases No. 4,024/61 (BRASIL, 1961), which says: "The education of exceptional, must, in what is possible, fit into the general system of education, in order to integrate them into the community". Subsequently, the law was repealed, being replaced by Law No. 5,692/71, and this, supplanted by Law No. 9,394, of December 20, 1996, in force to date.

Another important body for the development of special education in Brazil, in 1973, was CENESP, Special Education Center, responsible for coordinating and developing special education in all school stages, with the aim of promoting active and progressive participation in society (MENDES, 2015, p. 46-47). The same body was later renamed as Secretariat of

Special Education in 1986 and in 1990 called the Secretariat of Basic Education, which eventually reached its current name, in 1992, as Secretariat of Special Education.

With the Federal Constitution of 1988, in Article 208, it is now guaranteed the permanence of students with some type of disability in regular classrooms (BRASIL, 1988).

Between 1994 and 2002, we can highlight the document "Policy and Results Special Education", prepared by the Ministry of Education (BRASIL, 2002). In this, it is possible to find an analysis of education in Brazil in the period mentioned, a picture with perspectives and advances (BAPTISTA, 2019, p. 8).

In terms of orientation to public educational policies, the "National Policy of Special Education in the Perspective of Inclusive Education" of 2008 (BRASIL, 2008) remains as a reference for Special Education in Brazil. It is considered a milestone for the history of Special Education in Brazil, because it legally refers to the national option for the inclusive perspective in the educational field. The document also explicitly presents the definition of the target audience to be served by special education – people with disabilities, global development disorders and high skills/gifted. It also establishes the fundamental aspects for Specialized Educational Care - ESA.

Given the context presented, it is possible to observe that all individuals have the right to education, however, to fully enjoy this right, this struggle is just beginning. It is up to us, future teachers, to fight to conquer this right and thus bring to children, young people and adults a quality inclusive education, and that everyone can actively participate in classes, with their limitations and characteristics, which show how unique and extraordinary individuals are. Thus, it will contribute to the improvement of the social development of the country.

Visual impairment

Visual impairment, according to the Department of Education, is characterized by the total or partial loss of the sense of vision, thus losing the basic functions of the eyes. Enter the category of visual impairment the blind or low-vision person:

> **Blind**: blindness presupposes lack of visual perception due to physiological or neurological factors. Total blindness or simply amaurosis is characterized by complete loss of vision without visual perception of light and shape. Blindness can be congenital or acquired. **Low Vision**: the visual acuity of people with low vision is very variable; but, in general, low vision is defined as a condition in which a person's vision cannot be fully corrected by glasses, interfering in their daily activities, as well as reading and locomotion (CONDE, 2017, p. 1, author's emphasis, our translation).

It is based on two ophthalmologic scales, which perform the grouping of people who have some type of blindness or low vision, being them, visual acuity, characterized as what can be seen at a certain pre-established distance, and the field of view, which corresponds to the enlargement of the area that vision can reach. The person is considered blind if he meets one of the following criteria: the corrected vision of the best of his eyes is 20/200 or less, that is, if he can see at 20 feet (6 meters) what a normal-vision person can see at 200 feet (60 meters), or if the wider diameter of his visual field means an arc not greater than 20°, although its visual acuity in this narrow field may be greater than 20/200. This restricted visual field is often called "tunnel vision" or "pintip" and these definitions call some "legal blindness" or "economic blindness" (CONDE, 2017, p. 1).

The person with low vision has difficulty performing his personal activities from day to day, and this individual can be diagnosed from some clinical conditions, namely macular degeneration, glaucoma, diabetes, retinopathy or cataract.

Throughout history, we can observe that people with visual impairment, and others, were seen as incapable and, with this, ended up being rejected by society, excluded in their own families, suffered prejudices and intolerance, as Mendes (2015) states. According to the author, the child who was born blind in Ancient Greece should be placed in a clay canister and abandoned. Around the 5th century BC., the Greeks already seek a cure for blindness. One of the doctors who receives prominence in this period is the Alcmeon of Cretona, known to discover the optic nerve. In ancient Rome, people who had some kind of disability and, consequently, could not be useful in a war, could end up condemned to death.

It can also be highlighted that, due to the more sensitive tact, there is the report of blind people working as healers of judges in the mid-2nd and 3rd century BC.

In the first, there were blind people working, many worked in the ports and began to receive aid, a type of pension, but this benefit did not have long duration. After, they lost their help and began to receive only daily feed. In the second, one can highlight the movement whose goal was to reduce the number of beggars in the streets, pressing the asylums and monasteries to receive more people in their spaces.

Among the Maya, blind people had a function, that of potter, due to manual skills and keen touch; individuals produced objects from raw materials such as stone, leather, wood, clay (COSTA; PICHARILLO; PAULINO, p. 10).

We can also highlight some blind students who, at the time of feudalism, played an

important role and worked as teachers, concertgoers, among other functions. Among they are Domius of Alexandria, also known as Didymin, the early, who was a theologian and directed catechesis for more than 50 years in his city.

Advances in medicine began from the 18th century on, with a deeper understanding of the eye and its ligament with the brain. We can see that, over the centuries to the mid-nineteenth century, blind people conquered more spaces, compared to what was before, which contributed to the history undergoing changes.

At the end of the 18th century, the first school of the blind was established in Paris, called the Royal Institute of the Blind Ovens. The main motivation for the creation of this institution was the high number of blind people living as beggars. Being on the front line, Valentin Hauy believed that blind people possessed the ability to learn through touch. From this institute, others have emerged in several countries, including Brazil, with the Institute of the Blind Boys, now called the Benjamin Constant Institute (MENDES, 2006).

In the Renaissance, we have some works that stand out with blind people being their focus, since the period culminates in the change from the Middle Ages to the Modern, with paradigms and beliefs being dismayed. The production depicts six blind people walking and falling into a jack. Such writing is a criticism of society that has no idea about the future, without knowing or having goals to be desired, completely lost.

The rights of people with disabilities gained evidence after World War II, through the Declaration of Human Rights, then with the 1988 Constitution in our country, and with the Salamanca Declaration. These were important milestones in the struggle for more equality, respect and dignity for this section of the population.

Article 66 of the Salamanca Declaration states that:

> Politicians at all levels, including school level, should regularly reaffirm their commitment to inclusion and promote positive attitudes among children, teachers and the general public with regard to those with special educational needs (ONU, 1994, p. 15, our translation).

With the Salamanca Declaration (ONU, 1994), the proposal for inclusive education gained emphasis and people with some kind of disability, including blindness, came to be considered capable of learning.

> School education was not considered necessary, or even possible, especially for those with severe cognitive and/or sensory disabilities. Educational work was relegated to an endless process of "readiness for literacy", without greater perspectives since there were no expectations regarding the ability of these

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> individuals to develop academically and enter formal culture (GLAT; FERNANDES, 2005, p. 2, our translation).

In the 1970s, the emphasis was on the lack of structure of schools and the unpreparedness of teachers to fully care for children with disabilities, and no longer on the disability itself. We have, then, the beginning of a change of thought. The school has the role of adapting and preparing to receive this student, both in the infrastructure part, with signs, access to all areas of the school, as well as in its political-pedagogical project (PPP), thinking about ways to evaluate, prepare materials and classes (GLAT; FERNANDES, p. 4, 2005).

According to Glat and Fernandes, the act of inclusive education is not only to insert the student into the regular classroom, but rather to ensure that any student with disabilities has access to an education that allows them to develop intellectually, social and physically, respecting the individualities of each student. Also, according to the authors, the number of studies related to special education in Brazil is scarce; thus, the inclusion process becomes difficult.

Basic issues such as the number of people with disabilities in Brazil; the age group of these people; the number of individuals who have access to a school; what deficiencies are present by segment; among others, they could serve as a support to develop a planning, aiming to increase the number of people with disabilities in schools, improve the teaching-learning process and carry out projects aimed at reaching people who fall into the teaching of young people and adults, the EJA, in order to offer an education for all.

The plurality and diversity that the school environment offers, provides students, teachers and all school staff, to grow and develop as a person, since one has the opportunity to live with the other, learn to respect, decide and think about the objectives and projects, that is, interact with the environment and with the other (ROGALSKI, p. 12, 2010).

The aspects presented were, therefore, the foundations of the research developed, whose methodology and results are presented below.

The development of research

Once the contextualization of inclusive education in Brazil has been carried out and the defining elements of visual impairment are presented, it is worth highlighting the methodological path adopted in the qualitative research (BOGDAN; BICKLEN, 1994). Initially, we intended to analyze the theses and dissertations found in the Capes Catalogue and

Theses and Dissertations and, for this reason, we maintained in this work the definition of the original general objective, since we understand it essential to highlight the circumstances that culminated in the different directions of the research.

For the search, we used the following keywords: teaching mathematics visual impairment, teaching mathematics and visual impairment, "teaching mathematics" and "visual impairment", "first-degree equations" and "visual impairment", "mathematics teaching" and "disability". However, when performing the search, we did not obtain any results in the thesis/dissertation format. Therefore, we chose to analyze the articles that fit the search. As a definition of a database for the research, using the same described, we then search for articles in the CAPES Journal Portal.

The first part of the research was composed of a bibliographic review of texts and articles, with the purpose of conducting a survey about the historical context of inclusive education in Brazil, with emphasis on laws that were created, aiming at improving teaching for people with visual impairment. Thus, it was possible to draw a brief timeline of the historical evolution of inclusive education, focusing on the most decisive points for the changes we see today.

Next, a theoretical-descriptive study was carried out, with the objective of understanding visual impairment and identifying the elements that characterize and define it. At this stage it was possible to list possible diseases that, when treated incorrectly, can lead to blindness or low vision. We also involved a brief history of blindness, already presented, considering the different ways in which blind people were seen, in certain times, and how this notion was changing with the evolution of medicine and the thought of society.

Soon after, the objective to be contemplated was to understand the process of teaching and learning mathematical contents involving students with visual impairment or low vision, especially the teaching of first-degree equations. In our search, we found nine articles that dealt with the teaching of Mathematics to students with visual impairment, but only six fit our theme, send the two with a broader approach. Finally, we present, below, the localized research, together with the specificities of teaching mathematics to blind students.

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Visual impairment and mathematics teaching

The teaching of Mathematics for blind students presents, in essence, a complementary challenge, since many of its concepts, aiming at the broad understanding of students, require a parallel with the immediate visualization with the concrete result of the calculations. These are said, the teaching resources available to assist the visually impaired in understanding graphs, for example, are insufficient and often inefficient (MACHADO, 2004).

In addition, few publishers produce teaching materials for the visually impaired and the scarcity of materials is great. Thus, it is necessary to develop alternative teaching methods so that these students can actually be included in the school community (SILVA Y LAZZARIN, 2017).

In the case of visually impaired students, the situation is even more difficult, since some adaptations are necessary, such as the use of the Braille Writing System, so that these students can make their notes and read the textbooks and Soroban for mathematical calculations. However, the teachers, for the most part, are not prepared to attend these students (MACHADO, 2004).

According to Vygotsky (1998), the limitations of visually impaired students are reserved for questions of mobility and spatial orientation, since intellectual development and the elaboration of concepts are identical to those of students who do not have this disability. Thus, it is up to the educational system (Estado, schools and teachers) to seek methods that help the learning of these students.

According to Miranda (2016), the mathematics teacher can use speech to facilitate the understanding of images, graphs and tables, for example, in order to describe the content contributing to the understanding of the blind student, but also of the visual students. For this task, the teacher needs to have a good relationship with the students; should also have the sensitivity to exercise empathy and put one's place in the place of others. So, the learning teaching process can flow smoothly and pleasantly to both sides.

For the use of spoken mathematics, it is of paramount importance that the teacher and the student have full access and science about the Braille system, because the student will use it for annotation and reading purposes. If the teacher has no mastery in the way the blind student writes and reads, communication between them will not be effective, directly impairing teaching. Thus, it is necessary that the mathematics teacher knows not only the basics of braille, but also about how mathematics is represented in this form of registration.

Currently, there are free software that reads screens of notebooks, computers, mobile phones, among other devices, facilitating communication, since it can be used as an alternative means in relation to braille. In this technological environment, the mathematics teacher can also rely on oral calculators.

Making the use of manipulated materials is a practice that can be adopted in order to facilitate the understanding of the blind student, and make him appropriate the knowledge in question. Simple and low-cost materials, with modeling mass, PET bottles, cardboard, among others can also be used in mathematics classes (MIRANDA, 2016, p. 133).

Another resource that the mathematics teacher can use is soroban, whose origin dates back to antiquity, when, for counting and marking purposes, we were made in ropes, counting pebbles, scratches on stones or bones, among others, as Oliveira points out (2016, p. 44).

We can highlight that, according to Oliveira, with the use of Soroban, not only for blind students, but for all, the benefits are relevant, because the tool improves logical reasoning, develops thinking and mental calculus, and can be used for various mathematical operations.

Once the resources and materials that can be used for educational work with visually impaired students have been identified, the research is focused on the survey of published scientific papers that deal with the teaching of first-grade equations to students with said disability.

Research focused on teaching first-grade equations to visually impaired students

To start the work of surveying the productions, a search was made with the terms' equations of the first-degree and visual impairment and no work was found, specifically in the thesis/dissertation format, aimed at teaching first-degree equations to students with visual impairment, as already exposed.

Based on the work of Ormindo (2019), it was possible to observe that, from 2008, there is the beginning of a greater movement in relation to laws and changes in the context of inclusive education in Brazil. In his research, Ormindo highlights the period in which the largest number of researches related to the teaching of Mathematics for students with Asperger syndrome appears.

Given this scarcity of theses and dissertations, we chose to look for articles related to the teaching of mathematics to blind students, and later, the teaching of first grade equation for blind students.

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The terms used for the search were as follows: teaching visual impairment mathematics, teaching mathematics and visual impairment, "teaching mathematics" and "visual impairment", "first-degree equations" and "visual impairment", "mathematics teaching" and "disability". By using the quotation marks and the term and in place of "e", it was possible to close the expression to be searched and perform the search with the same expressions appearing in the same text, that is, the search can be more specific.

Thus, when closing the expression and searching for: "teaching mathematics" and "visual impairment", seven articles were found. In new research, a few days after the first search, it was possible to find two more articles, using the same descriptor, totaling nine articles.

The first article found, entitled "Dialogue with students with visual impairment (Dv's) as a Formative Instrument for a Teaching of Inclusive Mathematics" written by Pereira and Borges (2020) is research with four blind students, currently within the academic context, on school life, focusing on the discipline of Mathematics. They report what their difficulties were, how they faced them, how their teachers were, among other issues. The authors also highlight the need for research such as this, given the scarcity of the cut, also focusing on inclusion, aiming at practices that aim to reach all students in the regular classroom, respecting the characteristics of each one:

> Thus, investigating ways to propose inclusive practices that include the individual needs of students with visual impairment, but at the same time, also extend to all students, it is necessary, after all, we believe that including is synonymous with making participation available in the debate about the same knowledge. Beyond Educ. Math. Research., São Paulo, v. 22, n. 2, p. 281-311, 2020 289 of this, we believe that this attitude develops in all students respect and solidarity in relation to their colleagues with greater difficulties, which constitutes one of the most important objectives of education (PEREIRA; BORGES, 2020, p. 288-289, our translation).

This work highlights the blind student's point of view, becoming of paramount importance for the understanding, by teachers and researchers in the area of education, since the report of experience of the blind student will contribute to the teacher broadening his/her view and understanding of the difficulties faced day by day by the blind students, especially in the discipline of Mathematics, visualization is necessary for the understanding of various concepts.

The second article found, "Training of Mathematics of Undergraduates in Pedagogy: an analysis in the light of methodological pluralism", authored by Costa *et al.* (2017), brings the importance of methodological pluralism for the teaching of Mathematics. The research was

carried out with a class of the pedagogy course, in order to verify if the knowledge about mathematics teaching had been realized, after all, they would, in the future, be in front of a regular classroom ministering the proper contents.

At one point in the research, the students had to answer a sequence of exercises with the help of Soroban, material also used by blind students, to aid in mental calculus.

The third article found, "Teaching Mathematical Concepts to students with visual inclusion impairment", authored by Viginheski, Silva and Himazaki (2020) addresses the teaching of algebraic thinking to a regular classroom of public education of the 8th year with 42 students enrolled, being a blind student. At the end of the research, the authors found that, making the necessary adaptations, all students in the room appropriated the content in question:

> In an interview with the student T. A., it was observed from her report that the greatest difficulties faced, when attending regular education, were related to the lack 264 Educ. Math. Research., São Paulo, v.21, n.3, 250-271, 2019 of teachers' knowledge about their visual condition and the lack of modified materials that would enable their access to the knowledge taught. Most teachers used orality to explain the contents to her, but she could not understand many unmodified visual things, such as the development of an equation (VIGINHESKI; SILVA; HIMAZAKI, 2020, p. 263-264, our translation).

Again, it is clear the role of the teacher in the process of teaching learning of a blind student. Previously said, mathematics requires a degree of abstraction on the part of students, so it is up to the teacher to reflect on the paths he can use so that all students, including students with visual impairment, can appropriate the knowledge in question.

In the fourth article found, "Math2text: Software for generation and conversion of mathematical equations into text - limitations and possibilities of inclusion", authored by Szesz Júnior, Mendes and Silva (2020), the focus is the Math2Text software, which presents the blind student with the equations in a read text format. The results obtained through the experimentation of the software by a teacher and a group of blind students are presented. According to the authors, the process is valid and brings good results.

As stated earlier, there are applications and software that transform text into audios so that blind people can be more connected with information, facilitate and contribute so that the person with visual efficiency, or low vision, can also use this tool in the school environment.

The fifth article, "The use of (auto)biographical narratives as a possibility of researching the practice of teachers about inclusive Education (Mathematics)", authored by Rosa and Baraldi (2015), brings pertinent reflections. Although it has a broader perspective on the

inclusion and adaptation of materials, it offers the reader a moment of reflection through the reports, not specifically related to visual impairment, or other deficiency, but presenting a more general character of the theme, from a differentiated and relevant perspective.

Experience reports and training memorials, for example, can be used in case studies and, through debates or round tables, contribute to the training of graduates and teachers already graduated. Since they offer the possibility of the reader putting into practice empathy and, with this, put themselves in the place of the other, also favoring the growth of the person as an individual.

The sixth article found in the search, "Mathematics Education: The articulation of inclusive and collaborative conceptions and practices", authored by Santos *et al.* (2019), deals with a grouping of parts of three studies related to inclusion, two researches of the Master's course and one of Scientific Initiation, from the São Paulo State University, UNESP, campus of Presidente Prudente-SP.

The article presents the data obtained in each research studied, which include the teaching of Mathematics to blind students, deaf students, among other disabilities. The authors conclude by discussing the importance of the training of the mathematics teacher and the willingness to try a new and differentiated methodology, in order to adapt some activities, and thus be able to offer all students the opportunity to have access to knowledge (SANTOS; LANUTI; ROCHA, 2019, p. 274).

The scarcity of research in the area of inclusion is a fact of the Brazilian academic society, when it comes to an even more specific theme, such as the treatise in this work, the teaching of a first-degree equation for students with visual impairment, the search does not bring any results. We see the same fact occurring in relation to other deficiencies, corroborating Ormindo's research: "As already mentioned, among the 70 papers located, only three belonged to the area of knowledge studied in this work – mathematics". (ORMINDO, 2019, p. 58). Based on this author, we note that there are studies that relate the deficiencies in some way, however, the majority is centered in the health area, and the production of research in the educational field is more recent.

Three other articles found in the search, made by "mathematics teaching" and "visual impairment", did not have a direct or indirect connection with the theme of this research, so we decided not to include them in this analysis. Our research resulted, then, in 6 articles, two with a perspective of the general theme about inclusive education.

Final considerations

As presented in the previous chapter, we saw that the number of articles related to the teaching of Mathematics and visual impairment is still extremely low. In our search, we found only nine articles, only 6 related directly or indirectly to the proposed research theme. When refining the search, filtering for a more specific content, the teaching of first-degree equation, for example, was not found in any work.

By analyzing the studies found, we can list some points in common. It embodies the scarcity of research in the area, the importance of further studies, teacher training, inclusion, in fact inclusive, and the openness that teachers need to have to adapt to new teaching methods, all in order to be able to reach all students.

The lack of research in the area of education leads us to the fact that, without the increase in the number of more general research, the number of researches with more specific themes, such as the contents of each discipline, will also not increase. Research covering a discipline, for example, more broadly, opens the possibility for other researchers to choose a theme or a front to be able to deepen.

For the teaching of Mathematics to blind students, for example, we see that there are some tools, such as Soroban and software, for example, that help in teaching learning. The role of the teacher is to facilitate this process, making it the least traumatic and most pleasurable for all students, since there is a culture that mathematics is only for a few. We defend the point of view that the student needs to know the historical process through which mathematics has passed and developed in order to be able to elaborate a reasoning and appropriate that knowledge in question.

Putting on the board a formula, explaining who are the parts that compose it, passing examples and exercises, do not guarantee that the student appropriates knowledge and that the teaching and learning process is properly completed. By using the historical part, how the formula developed, how to use manipulated materials that involve the subject in question, we can have a breakthrough in the development of students' learning.

Whether for visually impaired students or for normal-blind students, who have full vision, or for students with any other type of disability or extraordinary characteristic, the teacher needs to be prepared for an out-of-standards class, he/she needs to be willing to use online and manipulatable tools so that the bridge that connects the student to knowledge is more peaceful to cross. Thus, the student can be the protagonist of his own knowledge. By using manipulatable materials, the teacher offers students the opportunity to think about the

development of the activity and, in the end, students could give suggestions for improvements or even suggest ideas for new activities.

We also saw that the process to include the student with disabilities within the regular classroom was complex, needed several laws, congresses and people fighting for the right to access a quality education, as guaranteed by our 1988 Constitution, to be contemplated. However, this process of placing the student with disabilities inside the classroom requires a structure designed for that student, as well as a qualified teacher to be able to attend to the students; teaching, finally, needs to be thought of for all students. Thus, the fact that the student with disabilities is inside the classroom does not guarantee that he/she is learning and that inclusion is established.

After the student's entry into the classroom, there is a moment of reflection, on the part of teachers, management and school collaborators, about the possibilities for the subject to feel part of the class and, thus, to actually include.

This research contributes to have a broad view of the number of articles existing in the CAPES Journal Portal, since the Catalogue of Theses and Dissertations did not return any results. This reveals that it is of paramount importance to have an increase in the number of research and data related to the area of education, the teaching of mathematics and the teaching of specific content. With this research, it was possible to make a survey of the data that has been available until the end of 2020.

Finally, this study opened a range to look at other disciplines, such as History, Geography, Physics, among others, and to reflect on the teaching of these curricular components for visually impaired students.

REFERENCES

BAPTISTA, C. R. Política pública, Educação Especial e escolarização no Brasil. **Educ. Pesqui.**, São Paulo, v. 45, e217423, 2019. DOI: http://dx.doi.org/10.1590/S1678-4634201945217423

BOGDAN, R.; BIKLEN, S. **Investigação qualitativa em educação**: uma introdução à teoria e aos métodos. Porto: Porto Editora, 1994.

BRASIL. Ministério da Educação. **Lei n. 4.024, de 20 de dezembro de 1961**. Fixa as Diretrizes e Bases da Educação Nacional. Brasília, DF: MEC, 1961. Available: http://www.planalto.gov.br/ccivil_03/leis/l4024.htm. Access: 10 Feb. 2021.

e-ISSN: 2446-7154

BRASIL. Ministério da Educação. Secretaria de Educação Especial. **Política Nacional de Educação Especial na Perspectiva da Educação Inclusiva**. Brasília, DF: MEC; SEESP, 2014.

CONDE, A. J. M. **Definição de cegueira e baixa visão**. 2017. Available: http://www.ibc.gov.br/images/conteudo/AREAS_ESPECIAIS/CEGUEIRA_E_BAIXA_VISAO/ ARTIGOS/Def-de-cegueira-e-baixa-viso.pdf. Acesso em: 15 out. 2020.

COSTA, A. B.; PICHARILLO, A.; PAULINO, V. C. O processo histórico de inserção social da pessoa cega na Antiguidade. *In*: ENCONTRO NACIONAL DE PESQUISADORES DA EDUCAÇÃO ESPECIAL, 10., 2016, São Carlos. **Anais [...]**. São Carlos, SP: UFSCAR, 2016. Available: https://www.researchgate.net/publication/311295338_O_processo_historico_de_insercao_social_da_pessoa_cega_na_Antiguidade. Access: 4 Nov. 2020.

COSTA, J. M. *et al*. Formação em Matemática de Licenciandos em Pedagogia: uma análise à luz do pluralismo metodológico. **Bolema**, Rio Claro, v. 31, n. 58, p. 719-738, ago. 2017. Available: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-636X2017000200719. Acesso em: 08 out. 2020.

GLAT, R.; FERNANDES, E. M. Da Educação Segregada à Educação Inclusiva: uma Breve Reflexão sobre os Paradigmas Educacionais no Contexto da Educação Especial Brasileira. In: **Revista Inclusão**, Rio de Janeiro, n. 1, 2005. Available: http://forumeja.org.br/sites/forumeja.org.br/files/Da%20Educa%C3%A7%C3%A3o%20Segregada%20%C3%A0%20Educa%C3%A7%C3%A3o%20Inclusiva.pdf. Access: 10 Feb. 2021.

MACHADO, V. C. **Aprendendo Matemática através das mãos**: uma proposta para o uso do Multiplano no ensino de educandos cegos. Criciúma, SC: UNESC, 2004. Available: https://docplayer.com.br/9406194-Veridiana-cardoso-machado-aprendendo-matematicaatraves-das-maos-uma-proposta-para-o-uso-do-multiplano-no-ensino-de-educandoscegos.html. Access: 11 Oct. 2020.

MENDES, E. G. **A escola e a inclusão social na perspectiva da educação especial**. São Carlos, SP: UFSCAR, 2015.

MENDES, E. G. A radicalização do debate sobre inclusão escolar no Brasil. **Revista Brasileira de Educação**, São Carlos, v. 11, n. 33, 2006.

MIRANDA, W. Erros e obstáculos: os conteúdos matemáticos do ensino fundamental no processo de avaliação. **Margens**, Abaetetuba, v. 7, n. 8, p. 155-171, 2013. Available: https://periodicos.ufpa.br/index.php/revistamargens/article/view/2753/2879. Access: 11 Oct. 2020.

OLIVEIRA, D. **Modelagem no ensino de matemática**: um estudo de caso com estudantes cegos. 2016. 105 f. Dissertação (Mestrado em em Ensino de Ciências Naturais e Matemática) - Universidade Estadual do Centro-Oeste, Guarapuava, PR, 2016.

ONU. Organização das Nações Unidas. **Declaração de Salamanca.** Sobre Princípios, Políticas e Práticas na Área das Necessidades Educativas Especiais. Salamanca, Espanha,

e-ISSN: 2446-7154
DOI: https://doi.org/10.47519/eiaerh.v8.2022.ID6

1994.

ONU. Organização das Nações Unidas. **Declaração Universal dos Direitos Humanos**. 1948.

ORMINDO, L. F. **Ensino de Matemática para alunos com Síndrome de Asperger**: Revisão sistemática de Teses e Dissertações. 2019. Monografia (Trabalho de Conclusão do Curso de Matemática) – Instituto Federal de Educação, Ciência e Tecnologia de São Paulo, Itapetininga, SP, 2019.

PEREIRA, T.; BORGES, F. A. O diálogo com estudantes com deficiência visual como instrumento formativo para um ensino inclusivo de matemática. **Educação Matemática Pesquisa**, São Paulo, v. 22, n. 2, 2020.

ROGALSKI, S. M. Histórico do surgimento da educação especial. **Revista de Educação do IDEAU**, Caxias do Sul, v. 5, n. 12, 2010.

ROSA, F. M. C.; BARALDI, I. M. O uso de narrativas (auto)biográficas como uma possibilidade de pesquisa da prática de professores acerca da Educação (Matemática) Inclusiva. **Bolema**, Rio Claro, v. 29, n. 53, p. 936-954, dez. 2015. DOI: https://doi.org/10.1590/1980-4415v29n53a08

SANTOS, D. A. N. *et al*. Educação Matemática: A articulação de concepções e práticas inclusivas e colaborativas. **Educação, Matemática e Pesquisa**, São Paulo, v. 21, n. 1, p. 254-276, 2019. Available: https://revistas.pucsp.br/index.php/emp/article/view/38783/pdf#. Access: 11 Oct. 2020.

SILVA, T. S.; LAZZARIN, J. R. Matemática inclusiva: Ensinando matrizes a deficientes visuais. **Matemática Inclusiva: Ensinando Matrizes a Deficientes Visuais Ciência e Natura**, Santa Maria, v. 39, n. 1, p. 118-126, jan./abr. 2017. Available: https://www.redalyc.org/pdf/4675/467549116013.pdf. Access: 10 Feb. 2021.

SZESZ JÚNIOR, A.; MENDES, L. R.; SILVA, S. C. R. Software para geração e conversão de equações matemáticas em texto - limitações e possibilidades de inclusão. **RISTI - Revista Ibérica de Sistemas e Tecnologias de Informação**, n. 37, p. 99-115, jun. 2020. Available: http://www.scielo.mec.pt/scielo.php?script=sci_abstract&pid=S1646-98952020000200008&lng=pt&nrm=iso. Access: 11 Oct. 2020.

UNICEF. **Declaração mundial sobre educação para todos**. Conferência de Jomtien. Tailândia, 1990.

VIGINHESKI, L. V.; SILVA, S. C. R.; SHIMAZAKI, E. M. Ensino de conceitos matemáticos para estudante com deficiência visual em situação de inclusão. **Educação, Matemática e Pesquisa**, São Paulo, v. 21, n. 3, 2019. Available: https://revistas.pucsp.br/index.php/emp/article/view/39052/pdf#. Access: 02 Nov. 2020.

VYGOTSKY, L. **A formação social da mente**. São Paulo: Martins Fontes, 1998. Available: https://edisciplinas.usp.br/pluginfile.php/3317710/mod_resource/content/2/A%20formacao%2 0social%20da%20mente.pdf. Access: 02 Feb. 2021.

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